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Development of Rational Decisions of Contactless Control of Electric Drivers of Mining Machines

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Abstract: *Electromagnetic starters are switching devices operating with electromagnetic actions that are designed to start and protect the electric motors of the excavator and drilling machines. Everyone knows that earlier electromagnetic starters have been used widely, but progress developments have shown that semiconductor elements are positive since these elements include self selectivity and reliability when starting and stopping electric motors during a voltage fluctuation or avalanche voltage. This article deals with the switching of electric motors of the EKG-8I excavator and safe control of electric machines during switching.*

Keywords. Driver, contactless, block, DC, AC, block, excavator.

Introduction

It is known that mining and electromechanical machines are used for earthmoving work, drilling wells, transferring and distributing minerals in a certain direction is carried out under the pressure. The excavators are cyclizing machines that are designed for excavating rock and soil and then loading it to transport vehicles [1]. In the field of application, excavators are divided into mountain and construction. Mountain excavators, in comparison with construction, are characterized by greater mass, size, power and more severe working conditions [2]. Career crawler excavators have a multi-motor drive consisting of the main drives: drives of the head, lift, turn and stroke mechanisms, as well as auxiliary ones: compressor, pump and fan drives, motors. The electric drive can be a constant and an alternating current [3]. The main electromechanical equipment of the excavators uses constant electric energy from the electric motors connected to the (generator) by electric motors of direct current [4]. Career crawler excavators have a multi-motor drive of the main drives: head drives, lifting, turning and running mechanisms, as well as auxiliary ones: compressors, pumps and fan drives, motors. The electric drive can be a direct or alternating current. The main electromechanical equipment of the excavators uses constant electric energy from electric motors connected to the (generator) by DC electric motors. The complete switchgear of the KDE-6 kV excavator line transmits 6 kV, the line of the engine of the engine that has the NDDE-15-34-6 U2 power of 630 kW, through the switchgear 6 kV is simultaneously transferred to a high voltage of 6 kV on the transformer TOE-160/6 to provide electric power to the auxiliary parts of the excavator. All auxiliary devices of excavators use 0.4 kV voltage and they are switched to the circuit using an electromagnetic starter.

Materials and methods

Intensive development of power electronics in recent years, the results of which was the creation of power electronic devices capable of commuting with a high flow of power. Also, the introduction of integrated circuits of imiprocessor devices creates favorable conditions for improving the quality of electrical apparatus by using electronic equipment elements in their construction.

Figures 1 and 2 shows the power circuits of the main and auxiliary circuits of the ECG-8I excavator.

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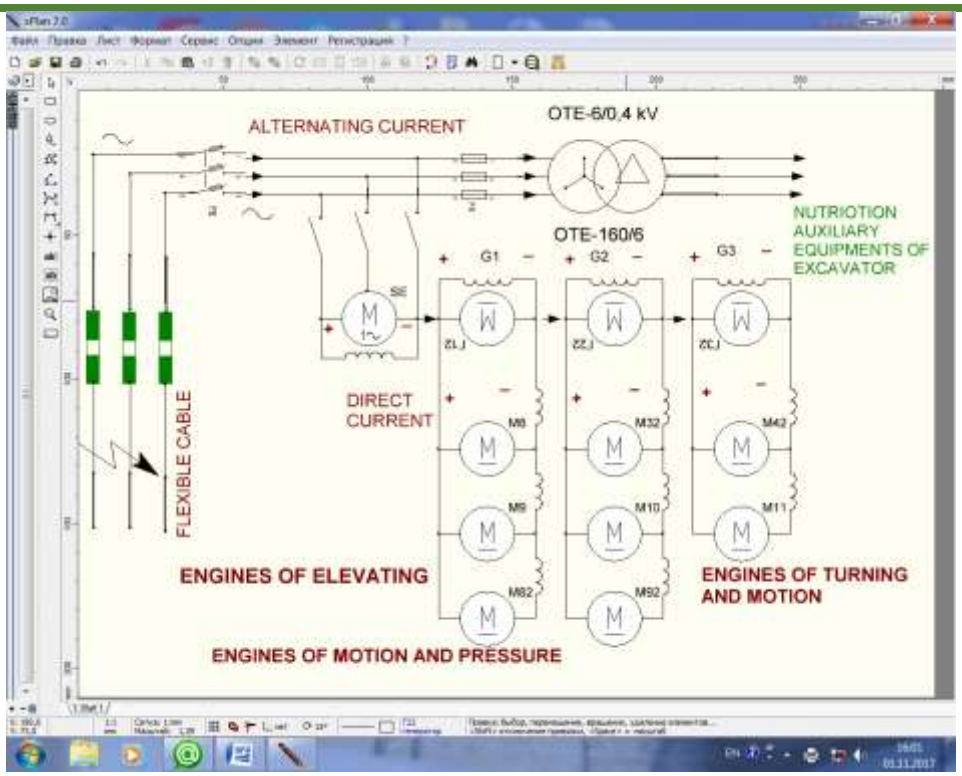

Figure 1. The scheme of supply of the main circuits of ECG-8I

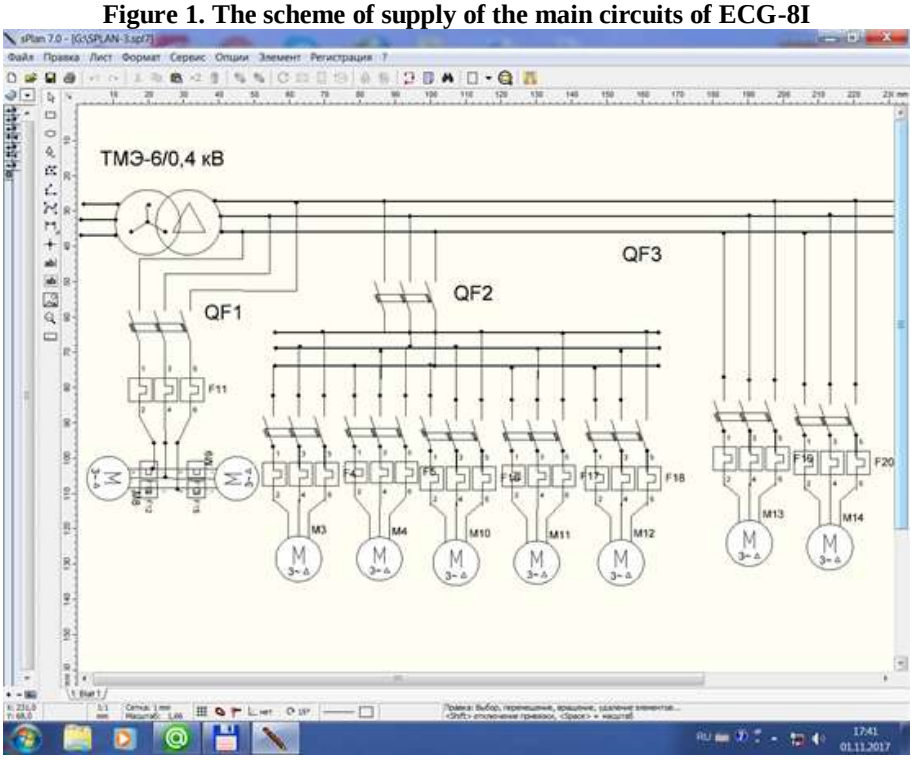

Figure 2. Scheme of supply of auxiliary circuits ECG-8I

The mining industry pays much attention to the development of rational solutions for electromechanical equipment of the mining machine and since the management of contactless devices is so important for the management of mining electromechanical equipment. The use of electronic switchgear improves the quality of switching devices and especially their switching and mechanical wear resistance. In power electronics, they are becoming more impressive. These power semiconductor devices (one operating and two operating devices using thyristors, opt couplers, powerful bipolar transistors and triacs), which today are able to commute currents in electrical circuits from a hundred amps to several thousand at operating voltages of hundreds and thousands of volts and power management.

Result and discussion

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Powerful semiconductor diodes and single-ended thyristors began production from the mid-1960 years and began to use these devices in power switching devices for control and protection (contactors, starters, switches). Application in them for the sake of arc commutation of the electrical circuit as the main power element of the electronic commutating apparatus (EPC), based on these power semiconductor devices (PSD), made it possible not only to increase the wear resistance and speed of the new devices, but also to carry out more complex management processes than an "on-off" operation. It also contributes to improving the quality of protection of electrical equipment. This created favorable conditions in various industries to obtain a significant economic effect by optimizing technological processes. Power contactless thyristor switches, alternating and direct current, having high wear resistance and providing a high level of current limitation when the short-circuit in the load is cut off.

Powerful single-acting thyristors have been created, capable of withstanding short-time current transients up to several tens of amperes. All this allows us to design semiconductor automation, protection and regulation of alternating and direct current with improved technical and economic indicators. High technical and economic indicators of semiconductor automation, the flexibility of their adjusting characteristics and the ability to perform in one device the functions of various devices. Convenience of their interface with elements of automation and microprocessor technology created favorable conditions for the development on the basis of these devices of automated low-voltage complete devices (LCD) that meet the highest requirements of modern industrial production.

The proposed non-contact device is characterized in that it has a simple control circuit and design. These devices can be used as a switching device in DC and AC circuits.

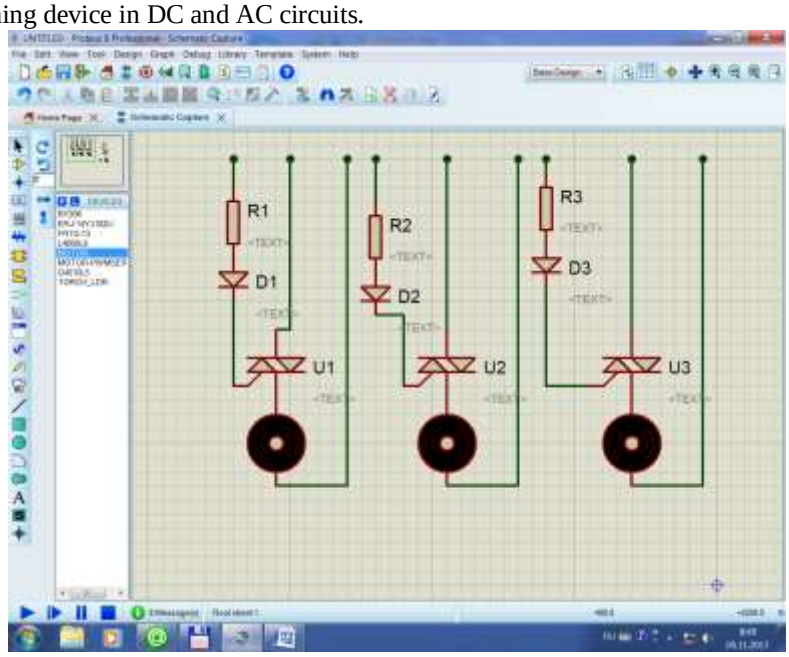

Figure-3. The scheme for starting a DC motor with a non-contact device.

In figures-3, the UNTITLED-Proteus 8 Professional laboratory program for connecting electrical circuits is shown, this program allowed us to analyze the contactless method of controlling the basic equipment of the ECG-8I excavator.

Before, to carry out any operation, we got acquainted with the technological passport data of electric motors and chose a DC motor having an active power of 50 kW. Accordingly, with the constant-current motor parameter, we connected the semiconductor triacs VS1, VS2, VS3, to each electric drive of the excavator. After the semiconductor is installed on the motor, we check the control control electrode of the triac, and then we can determine how much electric current is transferred to the reference control electrode it opens.

Conclusion

According to the rules of electronics, each electrical circuit must be connected with an appropriate resistance parameter to ensure stable operation of electrical circuits and to prevent short-circuit electrical equipment. Then, according to the rules of electronics, a resistance resistor was connected to the diode and a positive analysis of the contactless start-up of electric drives of mining electric machines was obtained.

The use of contactless elements in the control of motors, environmentally-friendly and harmful in many enterprises protects against damage to electric motors and warns against fire. At present, non-contact electronic devices using low power, noiselessness, small size, accurately and reliably operate in electrical installations. The use of thyristors for switching in electrical installations and their circuits operating in a new way is important and economical.

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